

REMARKS/ARGUMENTS

Remarks Regarding Claim Amendments

Support for the amendment to claims 17, 22, 32 and 33 are in original claims. No new matter has been added and entry of the amendments to the claims is requested.

Comments regarding 35 U.S.C. § 112

Claims 17, 21-23, 32 and 33 stand rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. Specifically, the Office Action alleges that the specification fully described “delta ^{14}C values and charts” but not “delta 14 value” and asked for correction. Applicants respectfully traverse.

Solely in an effort to expedite prosecution, Applicants have amended the claims to recite “delta ^{14}C ”, a phrase that the Office Action stated as “fully described.” This rejection is moot in view of Applicant’s amendment and the withdrawal of the rejection of claims 17, 21-23, 32 and 33 stand rejected under 35 U.S.C. § 112, first paragraph is respectfully requested.

Claims 17, 21-23, 32 and 33 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite for the phrase “delta 14 value.” Applicants respectfully traverse.

Solely in an effort to expedite prosecution, Applicants have amended the claims to recite “delta ^{14}C ”. This rejection is moot in view of Applicant’s amendment and the withdrawal of the rejection of claims 17, 21-23, 32 and 33 stand rejected under 35 U.S.C. § 112, first paragraph is respectfully requested.

Comments regarding 35 U.S.C. § 103

Claims 17, 21-23, 32 and 33 stand rejected under 35 U.S.C. § 103 as allegedly obvious in view of Wild and Hedges. Applicants respectfully traverse. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be

some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991.) See, MPEP Section 706.02 (k).

As discussed below and attested by Dr. Jonas Frisen ("Frisen Declaration" attached herewith), the claimed invention is not obvious in view of Wild and Hedges at least because (1) there is no motivation to combine the references, There is no reasonable expectation of success even if the references were combined and (3) a combination of the references would not lead the Applicants' claimed invention.

The Claimed Invention

The present invention, as disclosed in the specification and claimed in the pending claims, is the first disclosure of a reliable method for determining the age of birth of an animal. The claimed invention is novel and nonobvious over other dating methods known at the time of filing, including Wild and Hedges, at least because none of the other methods or a combination of these methods, allows the determination of a "birth date" of any animal - which is the subject matter of the instant claims.

In particular, the claimed invention is novel because it can be used to determine the "birth date" of an organism from tooth enamel - a determination that is not possible with the methods of Wild, Hedges, or a combination of Wild and Hedges. That is, a combination of Wild and Hedges does not teach or suggest a method to determine birth dates.

The use of tooth enamel for the measurement of a "birth date" is discussed throughout the originally filed application - particularly in the section entitled "Example 3" on pages 23 and 24. The claimed method of birth dating involves collecting a sample

of tooth enamel from an animal which is purified away from other carbon containing molecules of said animal, determining a delta ^{14}C value of the carbon atoms in said tooth enamel; and comparing the delta ^{14}C value with a calibration delta ^{14}C chart and determining a birth date of said tooth enamel. Importantly, the method of the claimed invention can determine a birth date of an animal to within 5 years of its actual birth date. This method is recited explicitly in claim 17 and incorporated by dependency into every pending claim of the instant application.

Numerous advantages are achieved with the present invention. For example, birth dating may be carried out with small amount of tooth enamel - even if the sample is substantially degraded and other organic matter, such as lipids and collagen are missing.

The current methods of ^{14}C dating, as exemplified by Wild and Hedges, cannot provide information for determining a "birth date" of an organism to within 5 years, as claimed in the instant claims. Since ^{14}C is in constant turnover, current methods of ^{14}C dating, at best, can only determine the date of death of an organism - when the organism stops incorporating new ^{14}C . Since an animal, such as a human, can have a lifespan of 10, 50 or even 100 years, the date of death provides almost no information of the birth date of an animal and cannot provide information of the birth date of an animal to within 5 years as claimed in the present claims.

No motivation to combine Wild and Hedges

A person of skill in the art would not find a motivation to combine the disclosures of Wild and Hedges for the reasons stated below. Wild is directed to the measurement of "the time of death" by measuring organic components with a rapid turnover rate. See, for example, Wild's abstract which states "[w]e also studied the applicability of the ^{14}C method in forensic sciences to determine the time of death of human individuals" (emphasis added). Wild also stated "the aim of this investigation was to find organic components of the human body with a rapid turnover time, so that measuring the $^{14}\text{C}/^{12}\text{C}$ ratios of their organic fractions and comparison of the derived values with the atmospheric "bomb" peak would lead to an accurate estimate of the time of death of the

human individual”. (Wild, page 274, first partial paragraph.) To determine the age of death, Wild extracted lipids from bone and bone marrow for study. See, Wild, page 274, 4th full paragraph. Thus, it is clear that Wild is directed to finding organic components of the human body with a rapid turnover time, such as lipid, so that the time of death may be accurately determined. See, also, Wild, page 280 which states that “From our results it can be concluded that for the determination of the time of death of humans - often an important question in forensic investigations - application of the ^{14}C method yields good estimates, provided that lipids from bones or from bone marrow are available. In case of advanced decomposition, where lipids are already degraded, hair is a good alternative for such investigation” (emphasis added). Thus, it is clear that Wild depends on the use of lipids from bone or marrow and that Wild’s method would not work if the lipids were decayed. Wild does not contemplate determining “birth dates” because measurement of rapid turnover molecules cannot be used to determine birth dates. ^{14}C dating is based on detecting ^{14}C levels of biological samples after the sample has ceased to incorporate additional ^{14}C . For a rapid turnover molecule, such as the molecules Wild uses for his methods, the molecule only ceases to incorporate ^{14}C after the death of the animal. An analysis of a rapidly turnover molecule can only determine a date of death. Since Wild is directed to rapid turnover molecules, Wild does not suggest the use of tooth enamel as is claimed in the instant pending claims. In fact the use of tooth enamel is not suggested or disclosed by Wild.

As discussed above, Wild does not disclose the use of tooth enamel, the addition of Hedges does not cure the deficiencies of Wild because there is no motivation to combine the two references. Hedges’ method is different from Wild and the two methods cannot be combined because they are incompatible. Hedges is directed to a method of dating ancient samples by treating samples with (1) H_2O_2 and (2) HAc under vacuum and collecting and dating CO_2 which evolves under HAc . (See, Hedges, page 287, 2nd to 4th paragraph.)

Unlike Applicants’ invention as recited in the instant claims, Hedges never determined a birth date to within 5 years of actual birth for any of the tooth enamel

samples investigated. The determination of a birth date of any of Hedges' samples to within 5 years, as claimed in the pending claims, would be impossible using Hedges' method because Hedges' method had errors of between 80 to 1700 years (See Hedges, Table 1). Hedges provide no disclosure or suggestions on how the error rates can be reduced from 80-1700 years as disclosed in Hedges to 5 years as in the claimed invention.

A person of skill in the art would find no motivation to combine the samples of Hedges with the methods of Wild. That is because a person of skill in the art would understand that Wild and Hedges have contradicting and incompatible requirements for reagents. Wild requires acetone soluble lipids for determination of a day of death. See, Wild, page 274, section under "sample preparation". In contrast Hedges requires enamel to be treated under (1) H₂O₂ and (2) HAc under vacuum for CO₂ collection. (See, Hedges, page 287, page 287, 2nd to 4th paragraph.) Hedges' bone enamel is not soluble in acetone and Wild's lipids cannot survive acid and base treatment. For these reasons, Wild's method is incompatible with Hedges' method and a person of skill in the art would find no motivation to combine the two methods.

A Combination of Wild and Hedges is Nonfunctional

A person of skill in the art would realize that a combination of Wild and Hedges would lead to a method that is not functional. If Hedges' enamel is used in the method of Wild, there is no possibility of success because Wild is based on detection of ¹⁴C in acetone soluble lipids and enamel does not have lipids. See, Wild, page 274, section under "sample preparation". Enamel is composed of apatite, a compound that is insoluble in acetone. Wild's method relies on acetone to extract lipids from tissue samples. Since enamel is insoluble Wild's method cannot extract any meaningful carbon for dating purposes. For this reason, a combination of Wild and Hedges would not lead to any data indicating a "birth date" - as claimed in the instant claims.

A Combination of Wild and Hedges is Would Not Lead to All the Recitations of the Claimed Method

In addition, even if Wild and Hedges were combined (for the sake of argument since I believe that they cannot be combined to become a functioning method) the combination would not lead to Applicants' claimed method.

One significant advantage of the claimed invention is that it allows the determination of birth dates - a process that was not possible until the instant claimed invention. Traditional method of ^{14}C dating cannot determine the birth date of organism. The methods of the invention therefore fulfill a long-felt need for rapid determination of birth dates. Therefore, the claimed invention is directed to a process entirely different in its steps and results than any other study to date. All studies performed before the claimed invention, including those of Hedges and Wild, used carbon dating to determine tissue age (i.e., time of death of a tissue). Before Applicants' claimed invention, there has been no attempt to use carbon dating and the bomb-spike to determine the *birth date* of an animal.

While Wild and Hedges have used biological samples to determine a date of death, neither Wild nor Hedges has attempted to determine the birth date of an animal from biological samples - a process that is claimed in the instant claims. All carbon-14 dating thus far has been done to either determine (i) the age of a fossil (for archaeological samples) or (ii) the date of death of a specific tissue (for modern samples). None of these techniques can provide the "*birth date*" within an accuracy of 5 years - recitations of the instant claims. For at least this reason, the claimed invention is novel and nonobvious over the cited references.

For the reasons stated above, Applicants asserts that the claimed invention is novel and nonobvious in view of the cited references. The withdrawal of the rejection of claims 17, 21-23, 32 and 33 as allegedly obvious in view of Wild and Hedges is respectfully requested.

Additional Considerations

The Examiner is also urged to consider the fact that the novelty and importance of the claimed invention has been acknowledged by the scientific community. This is evident from the publication of a paper describing the claimed invention in the peer reviewed journal Nature (Spalding et al., 2005, Nature vol 437:333-334; **Exhibit 1**). Further, the inventors have received praise for the claimed method. The methods of the claimed invention was described by SEED magazine (SEED media group, NY, USA; Dec/Jan 2005, pg 88) as “one of the 10 most revelatory experiments, findings, discoveries and proofs of the year” for 2005 (enclosed as **Exhibit 2**).

CONCLUSION

Favorable action on the merits is respectfully requested. If further discussion of this case is deemed helpful, the Examiner is encouraged to contact the undersigned at the telephone number provided below, and is assured of full cooperation in progressing the instant claims to allowance.

While Applicants believe that no additional fees are required, the Commissioner is authorized to charge any additional fees that may be due, or to credit any overpayment, to the undersigned's account, Deposit Account No. 50-0311, Reference No. 34685-502 (Customer Number: 35437).

Respectfully submitted,

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